Poster SCF17

X-ray Compton Scattering Measurement of High Temperature High Pressure Water

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Compton scattering spectra of X-ray (173 KeV) of water were measured at sub- and supercritical region (from 423 K to 623 K at 20MPa). To get Compton profile (CP: difference of Compton scattering spectra from basic ones, which must be zero at high energy region) of these fluids at high temperature high pressure correctly, noise of background from measurement cell has to be reduced as much as possible. In this study, we report differences of Compton scattering measured with three different cells. Type 1 was 1/2 inch size of stainless steel tube. Due to Compton scattering from the cell because X-ray directly attacked the stainless steel wall of the cell, the CP was not zero at high energy region. Type 2 was totsu-type stainless steel cell attached with beryllium windows at X-ray paths. Both inlet and outlet tubes of fluid in the Type 2 were attached at bottom of the cell. In this case, upper side in the cell was void at ambient temperature and pressure and it was fatal to get correct CP because CP calculation requires the standard Compton scattering spectra measured at base condition, namely ambient temperature and pressure. Type 3 was the same design as Type 2 but the outlet line of fluid was attached at the top of the cell. Fluid inside the cell was filled at ambient condition and CP was satisfied with the criteria (zero at high energy region).